

**Neoniphargus branchialis, a new freshwater Amphipod from
South-Western Australia.**

By Professor G. E. Nicholls, D.Sc., F.L.S.

(Read May 13, 1924; Issued July 7, 1924.)

In a recent paper I described a new species of *Phreatoicus* taken from a small creek discharging into the King River. Associated with it was a small Amphipod, neither form occurring very plentifully. The same water yielded, also, a few small examples of a Crayfish (*Chaeraps preissii*, var. *angustus*), some of these being heavily infested with a Temnocephalan.

The Amphipod proved to be a new species of the genus *Neoniphargus*, the first, so far as I can ascertain, to be recorded from Western Australia. The discovery is of some interest, for, excepting the doubtful European species *N. moniezii*, the genus has been known, hitherto, only from Eastern Australasia, with Tasmania as its headquarters, where it is very generally associated with *Phreatoicus* and *Anaspides*.

Originally constituted by Stebbing (1899) to receive a Tasmanian species, described by Thomson (1883) under the name of *Niphargus montanus*, the genus *Neoniphargus* has been represented by nine species. Of these, seven are peculiar to Tasmania, one (*N. spenceri*) occurs in that island and also in Victoria, while *N. fultoni* is apparently restricted to the mainland. The latter is stated to have been taken from a spring at an altitude of 3,000 feet, *N. spenceri* being found beneath moss at the source of a spring about 2,000 feet, and (in Tasmania) in Lake Petrarch at an altitude of nearly 3,000 feet. The Tasmanian species likewise were all sub-alpine with the single exception of *N. exiguus*. This was taken, with *Phreatoicus australis* (elsewhere a sub-alpine species) in a streamlet, at a spot scarcely above sea level, under conditions closely paralleling those in which the Western Australian species were found.

***Neoniphargus branchialis*, n. sp.**

Specific diagnosis. Head almost as long as the two anterior segments, lateral corners rounded. Side-plates deep, rounded below, with few marginal setæ, 1-3 of equal width, the fourth deeper than broad emarginate, $1\frac{1}{2}$ the width of the third. Pleon segments 1-3 with inferior margins rounded, postero-lateral corners angular; pos-

terior margins of first and second slightly, of the third deeply, notched. Last segment with stout spinule on either side of base of telson, penultimate segment with a cluster of four spinules on either side. Telson twice as long as broad, cleft for four-fifths of its length.

Eyes large, reniform, close to margin of the head. Antenna 1 considerably less than half the length of body, first joint of peduncle longest and stoutest, second and third successively shorter and more slender, flagellum 11-jointed, about equal in length to the peduncle, accessory flagellum small, 2-jointed. Antenna 2 slightly shorter than antenna 1, peduncle long with four joints of which first and second are short and stout, the third elongate, the fourth shorter and more slender; the 8-jointed flagellum of the female scarcely exceeds half the length of the peduncle. In the male the flagellum with but six or seven joints of which three (1-3 or 2-4) bear calceoli. Mandibular palp with third joint slightly shorter than the second; on the first maxilla, the inner plate with but two setæ, outer plate with seven serrate spines, palp of both sides alike, with seven slender spines. Gnathopods 1 and 2 similar and of equal size, sub-chelate, the fifth joint produced into a lobe proximally and not widening distally, sixth joint scarcely quadrate (sub-cordate), palm convex, oblique, minutely denticulate. Gnathopod 2 and peræopods 1-3 bearing branched, lobate accessory branchial vesicles. Uropods 1 and 2 reaching to level of end of telson, uropod 3 elongated, outer ramus with minute secondary joint (?), inner ramus small without apical seta.

Length. Female 8mm., male 6mm.

Colour. In life, a dark grayish green; in spirit, a pale yellowish brown.

Habitat. Taken in February of this year, associated with *Phreatoicus lintoni*, and occurring somewhat sparingly in the waters of a shallow swamp and beneath a leafy liverwort clothing the banks of a small creek draining the swamp and emptying into the King River, W.A.

Detailed description. The body is smooth and free from setæ and spines. The head, measured dorsally, has a length almost exactly equal to that of the first two peræon segments combined. Hinged to its inferior margin there is a small, light coloured plate, approaching semi-circular in shape, which seems to be related to the base of the second antenna. This and the rounded postero-lateral corner of the head are hidden from view by the forwardly projecting side-plate of the first peræon segment. The first four side-plates attain a depth double that of the second segment. They are parallel-sided with rounded inferior margins, the fourth, however, having its pos-

terior border deeply excavate dorsally. The fifth is even wider than the fourth, but is rounded and much less deep than the four more anterior plates. The sixth and seventh are much less conspicuous and the former is deeply notched on its antero inferior border. In the metasome the pleura are considerably produced, with the inferior margin rounded and a well-marked posterior angle. Through the transparent pleura of the pleon region, the conical bases of the pleopods are visible, the side-plates of the peræon being slightly more opaque. The last segment of the urosome bears a pair of stout spinules close to the base of the telson, while on the preceding segment, some little distance to either side of the middle line, the posterior margin is excavate to form a tiny shallow notch lodging a short row of four spinules of which the second and third are the stoutest. The telson, which has a length almost equal to that of the rami of the first uropods, is cleft for nearly four-fifths of its length. It is somewhat narrow and its ends, obliquely truncated, are furnished with three stout spines.

First antenna (Pl. X., A¹). Short and moderately stout, first joint of peduncle nearly $1\frac{1}{2}$ length of second and $1\frac{3}{4}$ length of the third. The flagellum, scarcely as long as the peduncle, consists of 10 or 11 joints, all bearing setæ terminally and, among these setæ, upon all but the first and last articuli, there is a rod-like structure like that figured by Sayce in *N. fultoni* (1902, Pl. 7, A¹). The accessory flagellum is two-jointed, both joints bearing setæ and having a combined length about equal to that of the first two articuli of the primary flagellum.

Second antenna. This differs very little from that of *N. fultoni* as figured by Sayce (op. cit., Pl. 7, A²), the chief difference being that the penultimate joint of the peduncle is relatively longer in *N. branchialis*, and the 8-jointed flagellum is barely longer than that joint. In the male the flagellum has but six or seven joints of which the three proximal usually bear calceoli.

Mouth parts. The *upper lip* does not differ from that of *N. spenceri* as represented by Sayce (1900, Pl. 40, L¹), but the *lower lip* (op. cit., Pl. 40, 2) has the inner lobes rather more distinctly marked off. In the *mandibles* the spine row has but four, or at most, five, stiffly curved and pectinate setæ. The inner cutting edge in the left mandible consists, however, of four well chitinised teeth scarcely less developed than those of the outer cutting edge, while that of the left plate is delicate and bears several teeth with remarkable serrate edges. The palp has the first joint short, the second is long, the third slightly shorter. In this it differs from the condition in *N. spenceri* (Sayce, 1900, p. 240), but is in agreement with that figured by Thomson for *N. thomsoni* (1893, Pl. 6, Fig. 3), and by G. W. Smith (1909, Pl. 13, Fig. 4) for *N. yuli*. The *first maxilla*

approaches much more nearly to the condition of this appendage in *Niphargus*, the outer plate having seven (instead of *six*) more or less toothed spines. The palp has seven simple spines, the inner plate but two curved, simple setæ, apically situated. The *second maxillae* agree closely with the condition figured by Thomson (op. cit., Pl. 6, Fig. 6) excepting that in *N. branchialis* the outermost seta is strongly developed and spinose and is slightly removed from the rest. The inner margin of the inner plate is not fringed with setæ, again resembling *N. thomsoni* (and *Niphargus*) but differing from *N. spenceri*. In the latter a short spinule represents the well developed outermost spine of the western form.

The *maxillipedes* differ markedly from the corresponding appendages described or figured in all other species of this genus, in the relative shortness of both inner and outer plates. The former does not reach to the distal end of the first joint of the palp, while the latter scarcely extends beyond the base of that joint. Neither of these places is setose to nearly the extent existing in *N. spenceri*, while the apex of the outer plate bears only tooth-like spines; on the inner plate these are represented by five or six more slender spines. The numerous setæ upon the palp are simple.

Gnathopoda. Of practically equal length, the second is perhaps very slightly the stouter, though the hands are of equal size. The most important detail in which they differ from the condition described as existing in other species is that which concerns the shape of the carpos which, in *N. thomsoni*, is described as "broadly triangular," the wide base being distal. A similar condition is figured in *N. spenceri* and *N. fultoni*. In the latter, however, the posterior margin is shown produced into a distally situated knob. Stebbing (1899, 1906) cited this distal widening of the carpos as a feature of generic value, but in the diagnosis of the genus which appears in the work of Smith (1909) this character is omitted, although the latter author nowhere expressly states that his species depart from that condition. His figure of *N. yuli* emphasises the distal knob, but shows also the propod articulating with a part only of the distal border of the carpus.

In *N. branchialis* the gnathopods are generally found folded upon themselves (Pl. X., Gn. 1, Gn 2), in which case the propod seems to rest upon a broad base formed by a wide distal end to the preceding joint. In the extended condition, however, it is seen that the distal border of the carpus upon which the propod actually pivots is relatively narrow and the knob-like process lies at the proximal end; in this species, then, the carpus is widest proximally. The propod has rounded corners and appears sub-cordate or ovoidal with an emarginate proximal border. The curved dactyl is long and stout, closing down upon a minutely toothed, convex palm, its tip lying

between a double pair of spines. Upon the basos of both gnathopoda, particularly the first, are a number of long and flexible setæ. Similar setæ are found also upon the corresponding joint of the first and second peræopoda. Such setæ are represented by Sayce (1900, Pl. 40) as occurring sparingly upon the second gnathopod of *N. spenceri*.

The *Peraeopoda* call for little comment. The fifth peræopod is, as is usual in this genus, distinctly shorter than the fourth, the dactyl in every case terminating in a claw which is not supported by a secondary unguis but is spinose or serrate along its whole length. On the convex outer surface each dactyl bears a single well-developed plumose seta. This is apparently the case, also, in *N. fultoni*, Sayce figuring it upon the second and third peræopod.

The Western Australian species appears to be unusual, however, in the branchial appendages to the segments of the peræon. Normal branchial vesicles occur at the base of the second gnathopods and first to fourth peræopods but, in addition to these, a branched body with obtuse lobes was found attached to the base of the second gnathopods and the first and third peræopods. Upon the detached limb-bearing portion of the latter segment, three of these structures were seen, doubtless the pair normal to the segment and one accidentally separated from the preceding segment. There can be little doubt, therefore, that these accessory gills are related to all but the last of the gill-bearing segments. It was the presence of these accessory branchial organs that suggested the specific name.

Upon the second, third and fourth peræon segments marsupial plates are found, lacking, however, the fringe of setæ usually present. What is probably a rudimentary fourth plate is to be seen attached near the base of the third peræopoda. In the one female taken with an egg-laden brood-pouch there seem to be a few fringing setæ on the plates.

Uropoda. The first pair are moderately long, with peduncle longer than the rami; these are of equal length and truncated terminally and armed with a stout spine supported by several smaller spines. The second uropoda are very similar but shorter, not reaching quite to the end of the first pair. The third are longer than the first, and consist of a short stout peduncle and a long rod-like outer ramus furnished with spines at fairly regular intervals and terminating in what might be regarded as a conical spine. It ends, however, in one or more terminal setæ and there can be little doubt that Smith has correctly interpreted it as a rudimentary (vestigial) terminal joint. Along its inner surface the ramus bears a number of long plumose setæ. The inner ramus is a minute scale-like structure, bearing on one margin several long setæ.

Remarks. *Neoniphargus branchialis* may be readily recognised by the shape of the carpus of the gnathopoda, in which it differs from all hitherto described species. Except for the presence of a knob-like process, this joint has an outline almost rectangular, whereas in the other species of the genus it is described as "broadly triangular," the base of the triangle being the distal border of the joint. Added width is given to this end of the joint in some of these species by a distally situated process. In the western form, a triangular shape to this joint—closely resembling that of the Victorian and Tasmanian species—is suggested when the limb is folded, the proximal margin of the propod then resting against the whole length of the posterior margin of the carpus, the process appearing as the only free portion of the posterior margin. *N. yuli* shows a condition intermediate between that of *N. branchialis* and *N. thomsoni*. In *N. spenceri* this process is apparently undeveloped.

N. branchialis may be further distinguished from previously described species by the possession of branched accessory branchiæ and by the occurrence of *seven* spines on the outer plate of the first maxilla, and by the condition of the maxillipedes. Stebbing (1899) in his diagnosis of the genus, when dealing with the mouth parts of *Neoniphargus*, notes that, in the type species (*N. thomsoni*), these are nearly as in *Niphargus*, except that there are but six, instead of seven, spines on the outer plate of the first maxilla. In the several species which have been described since the appearance of Stebbing's work the first maxilla has been shown to be somewhat variable, but in none have seven spines been found on the outer plate of this appendage.

Elongated third uropods are found in all three of the Australian mainland species, whereas they are markedly shorter in the Tasmanian forms. Smith apparently overlooked the condition of these appendages in *N. spenceri* and *N. fultoni*, and inserted in his generic definition ('09, p. 73) the statement "uropoda . . . third pair only just projects beyond the others posteriorly."

In this respect, as well as in the elongated and greatly cleft condition of the telson, *N. branchialis* comes very near to the Australian species of *Grammarus*, which, according to Smith, are exactly intermediate in structure between the genera *Neoniphargus* and *Grammarus* as typically represented by the forms found in the Northern Hemisphere.

LIST OF REFERENCES.

1900. Sayce, O. A., Proc. Roy. Soc. Vic., Vol. 13, Pt. 2, 1900.
 1902. Sayce, O. A., Proc. Roy. Soc. Vic., Vol. 15, Pt. 1, 1902.
 1909. Smith, G. W., Tr. Linn. Soc. Lond., Vol. 11, Pt. 4, 1909.
 1899. Stebbing, R. R., Tr. Linn. Soc. Lond., Vol. 7, Pt. 8, 1899.
 1906. Stebbing, R. R., "Gammaridea," Bronn's Thierreich, 1906.
 1893. Thomson, G. M., Proc. Roy. Soc. Tas., 1893.

EXPLANATION OF PLATES.

X.

- A¹, A². First and second antennæ.
 Gn. 1. First gnathopod, folded.
 Gn. 1a. First gnathopod, extended.
 Gn. 2. Second gnathopod,
 br. branchia, br.¹ accessory branchia.
 m. marsupial plate.
 L 2. Lower lip.
 M¹, M². First and second maxillæ.
 Md. r., l. Mandibles right and left (toothed edges only).
 T. Telson.

XI.

- Mxp. Maxilliped.
 P¹—P⁵ First to fifth Peraeopoda,
 br. branchia, br.¹ accessory branchia,
 m. marsupial plate, m¹ rudimentary marsupial plate (?).
 Ur. 1—Ur. 3. First to third Uropoda. Third uropod drawn
 on slightly larger scale.